MASS. ED21.2: Sch 68/4

School Achievement

How Massachusetts Students and Their Schools Measure Up

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A Report on the 1988 Massachusetts Educational Assessment Program

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AUG 10 1989
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892/258

Massachusetts Department of Education
December 1988

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More than ever, the life that we are preparing our students to meet demands active engagement. It is no longer sufficient merely to know some basic facts or to perform some basic skills. To be effective in their lives, students must be able to recognize the relevance of their learning and to use it in controlling their world. In other words, their knowledge must be anchored in meaning. This is the real goal of education.

The assessment has provided useful information about students and schools in Massachusetts. It is up to us — educators, parents, and the public at large — to use the information in achieving that goal.

Harold Raynolds, Jr.
Commissioner of Education
Commonwealth of Massachusetts

School Achievement

How Massachusetts Students and Their Schools Measure Up

What do Massachusetts fourth, eighth and twelfth grade students know?

- **Most students have basic knowledge of the content areas assessed.**

  They can recognize significant events and important figures in American history, perform numerical computations, locate information in a text, make simple fact/opinion distinctions and have a basic knowledge of science. They are able to reason in practical situations that have a direct relevance to their own interests.

% students gr. 4	Toys might cost less after Christmas because
17	A. more people want to buy them.
74	*B. fewer people want to buy them.
5	C. they cost more to make in the winter.
4	D. store owners do not have sales in the summer.

% students gr. 12	To prevent disease, the human body naturally produces
8	A. enzymes.
87	*B. antibodies.
2	C. toxins.
3	D. viruses.

How well do Massachusetts fourth, eighth and twelfth grade students apply what they know?

- **Students have great difficulty applying what they learn in the classroom to the world about them.**

  Many fail to use their knowledge and skills when asked to solve non-routine problems or to consider situations that differ from those found in their school texts.

% students gr. 8	The four members of the Rogers family went to dinner at a restaurant where dinners cost from $6.00 to $10.00 per person. Afterwards, Mrs. Rogers left a tip for the waiter which amounted to about 15% of the cost of the family's meal. Which of the following would be the best estimate of the amount of the tip?
5	A. $0.70
36	B. $1.50
52	*C. $5.00
7	D. $22.00

Although most fourth graders were able to reason successfully about the effect of demand on the cost of toys, eighth and twelfth graders seemed unable to apply the same concept in a less personal context, as illustrated in the example.

% students gr.8	% students gr.12	Suppose the United States Congress passed a law that prevented American farmers from selling wheat to the Soviet Union. Which of the following would you expect to happen as a result?
9	5	A. The wages of farm hands would increase.
48	46	B. The price of wheat would rise in the United States.
33	45	*C. The price of bread would decline in the United States.
10	5	D. The cost of farm land would rise in the United States.

ACHIEVEMENT RESULTS
Social Studies

- **Students were knowledgeable about political and economic issues that they saw as relevant to their lives. Furthermore, they show an increasing awareness of their rights as they mature.**

% students gr.8	% students gr.12	It is legal for a bank to judge a person a bad risk and deny the person a loan based on the applicant's
4	3	A. marital status.
66	81	*B. financial history.
4	6	C. nationality.
4	3	D. gender.
21	6	E. none of the above.

- **Although students know specific facts, significant persons and dates, they find it difficult to place events in any historical context. More important, perhaps, they seem reluctant to use what they know to reason out a chronological ordering.**

  For example, in answering these questions, many students did not seem to realize that settlement in our country could not have taken place before the continent was discovered and that the founding of a colony must predate any national political events.

% students gr. 8	Which happened first?
9	A. Pioneers settled the West.
26	B. The Pilgrims settled in America.
59	*C. Columbus discovered the Americas.
6	D. The United States became a nation.

% students gr. 8	Which happened first?
17	A. the signing of the Declaration of Independence
6	B. the ratification of the Constitution
12	C. the beginning of the Civil War
65	*D. the founding of Jamestown

- **Although students can identify specific terms or concepts when they are presented in textbook examples, when given incidents from current events, they fail to make the connection.**

  Half of the students in grade 8 and sixty percent in grade 12 were familiar with the concept of checks and balances and could identify ways in which this control works. However, they were not as skilled in identifying applications in actual situations, as illustrated in the example.

% students gr. 12	In 1987, the Senate blocked President Reagan's attempts to have Robert Bork appointed to the Supreme Court. The action was an application of
26	A. the power of veto.
5	B. minority dissent.
31	*C. checks and balances.
39	D. judicial review.

- **Many students lack basic understanding of American history and our political system. Despite the emphasis placed on these topics in the curriculum, students appear to be lacking the conceptual framework that gives meaning to the specific facts that they are taught.**

% students gr.8	gr.12	The purpose of writing the Constitution of the United States was to
47	35	A. establish the independence of the United States.
4	2	B. record the history of the republic.
44	59	*C. define a system of government.
5	5	D. explain the value of democracy.

% students gr.8	gr.12	Which of the following best explains the meaning of "democracy"?
42	63	*A. Citizens participate either directly or indirectly in the governing process.
25	19	B. The government consists of executive, judicial and legislative branches.
21	12	C. Powers are divided between the state and federal governments.
8	4	D. The government controls business and industry.

ACHIEVEMENT RESULTS
Mathematics

- **Most students can apply mathematical procedures, but many lack an intuitive understanding of those procedures.**

  Although 76 percent of eighth graders and 83 percent of twelfth graders successfully computed the average of sets of numbers, when asked to describe the average of two different numbers, students chose the responses illustrated in the example.

% students gr.8	% students gr.12	The average of two different numbers is
8	7	A. smaller than either.
12	8	B. greater than either.
41	55	*C. halfway between them.
38	29	D. between them, but not always halfway.

- **When presented with problems, many students merely extract the numbers and manipulate them.**

  Given a drawing of a picture frame with the lengths of a side and the bottom shown, only 33 percent of the fourth graders could tell how much framing material had to be bought to build the frame. Half just added the two numbers given.

  This continues to be a typical solution at the upper grades, as illustrated in the example.

% students gr.8	A painter is to mix green and yellow paint in the ratio of 4 to 7 to obtain the color he wants. If he has 28 liters of green paint, how many liters of yellow paint should be added? (operation used)
10	A. 4 + 7
29	B. 4/7 x 28
17	C. 4 x 7
39	*D. 28/4 x 7
4	E. 28 x 7

ACHIEVEMENT RESULTS
Science

- **Students know basic facts about science, particularly those that relate to health and human functioning.**

% students gr.8	% students gr.12	How do the heart and lungs work together?
8	7	A. Movement of the lungs helps the heart to pump blood.
89	90	*B. The lungs supply oxygen to the blood which the heart pumps throughout the body.
3	3	C. The heart and the lungs work together to help digest food.

- **Students have difficulty applying scientific concepts to the world about them.**

  Although 84 percent of the fourth graders know that the earth revolves around the sun, eighth and twelfth graders gave the responses illustrated in the example.

% students gr.8	% students gr.12	The sun rises in the east and sets in the west. This statement means that the
45	47	*A. earth rotates.
49	47	B. earth revolves around the sun.

- **Although students can identify "correct" scientific procedures, such as the need for control and replication in experiments, they have far more difficulty in applying their knowledge outside the formal laboratory environment.**

  In answering the question shown at the right, students were easily distracted by reasonable statements (a hypothesis in A and a socially desirable view in B).

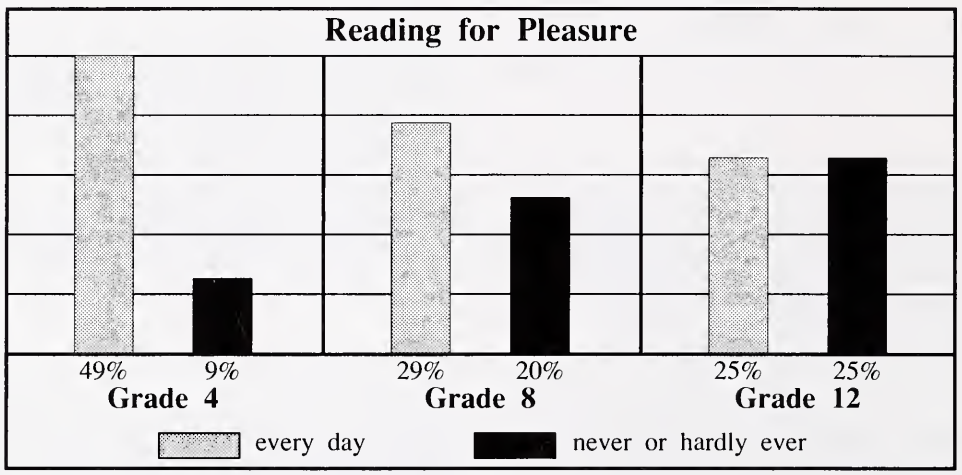
% students gr.8	% students gr.12	Because a factory dumps chemical wastes in a river in an area where there is a high incidence of cancer, the local citizens claim that the chemicals are causing the cancer. What are they assuming?
32	30	A. The chemicals are reacting with other materials in the water forming a poison.
26	20	B. Chemicals should not be dumped into rivers or streams.
36	46	*C. There is nothing else in the area that could be causing the cancer.
5	3	D. Cancer is a dreaded disease killing many people.

UNDERSTANDING STUDENT ACHIEVEMENT

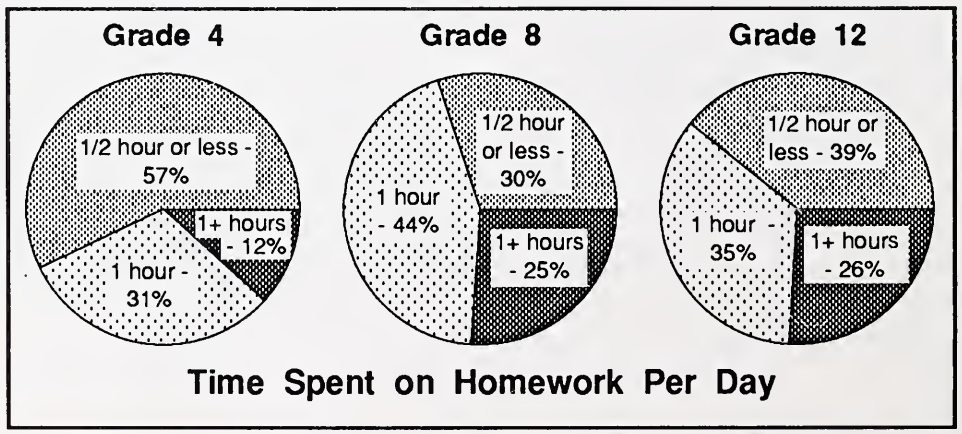
Why individual students perform well at school while others perform badly is a complex matter—too complex to be answered by a general survey such as the assessment. However, a survey can identify some of the factors that are related to performance.

Students: their activities outside of school.

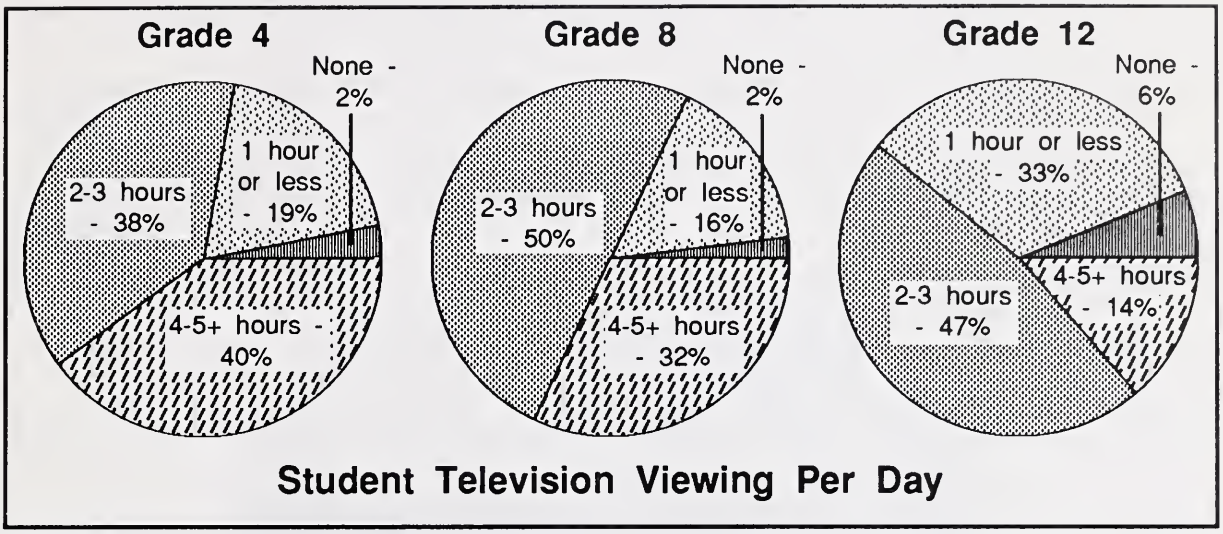
Students spend time reading for pleasure, doing homework, watching television and, at the high school level, working for pay. All these actvities are associated with achievement at school. For example, grade 4 students who read "almost every day" scored more than 150 points higher on the assessment than students who "never or hardly ever" read for pleasure.



Older students who spend at least an hour a day on homework score approximately 100-150 points higher than those who spend less time. Similarly, grade 12 students who work in excess of 16 hours per week score generally 100 points less than those who work fewer hours.

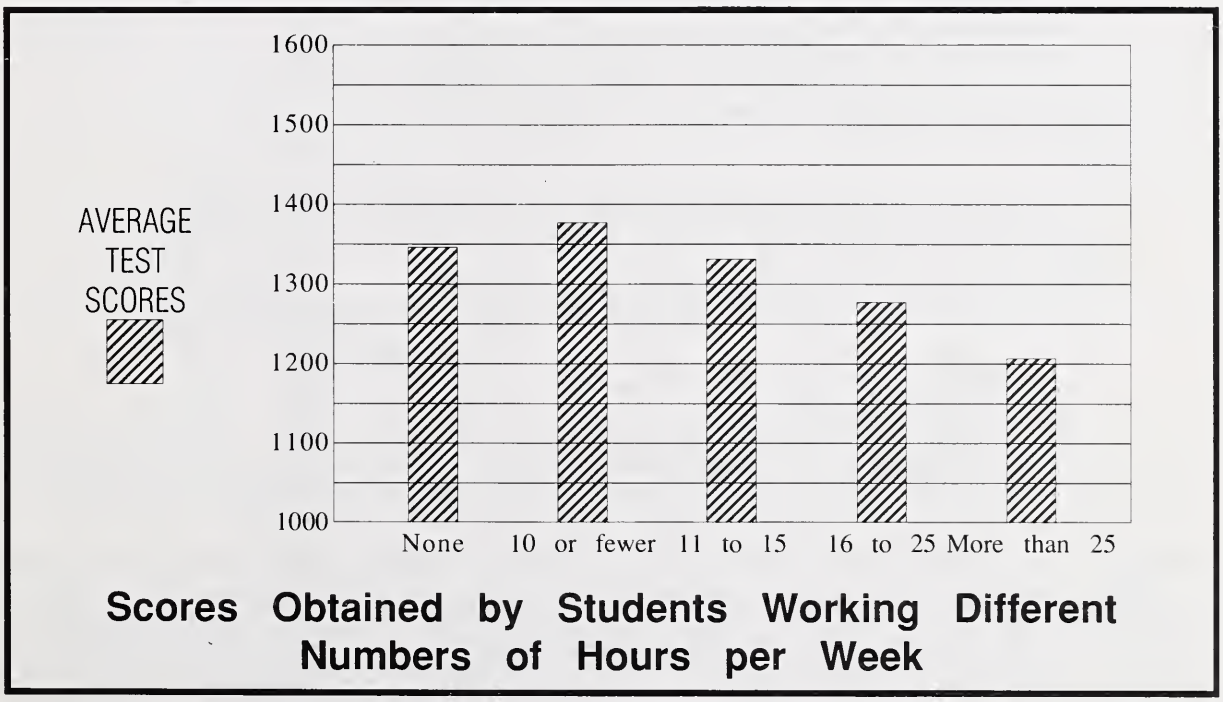

Grade 4
1/2 hour or less - 57%
1+ hours - 12%
1 hour - 31%
Grade 8
1/2 hour or less - 30%
1 hour - 44%
1+ hours - 25%
Grade 12
1/2 hour or less - 39%
1 hour - 35%
1+ hours - 26%
Time Spent on Homework Per Day

While moderate television viewing has little relationship to scores, the scores of those who watch for more than three hours a day are significantly lower than those of students who watch less. Finally, it should be noted that having someone at home with whom one can talk about school is an important correlate of achievement.



Student Television Viewing Per Day

Although none of these activities, singly or together, can be said to cause achievement, it is obvious that learning does not stop at the school gate. Students who spend their time outside of school applying their instruction in different contexts are extending and reinforcing what they have learned during the school day.



Scores Obtained by Students Working Different Numbers of Hours per Week

Students: their attitude toward learning.

What students do in school, how they feel about the subjects they study, and how they perceive the usefulness of those subjects are all associated with school achievement. Whether students feel positive about school because they do well, or they do well because they feel positive, is difficult to determine. However, the assessment did clearly indicate that, in general, students' attitudes change as they progress in their schooling.

At grade 4, students have a generally positive attitude and a good self-concept.

Question	Percent responding
My teacher expects me to do well	95%
I am a good/very good reader	87%
Science is my favorite/one of my favorite subjects	54%
Math is my favorite/one of my favorite subjects	68%
I enjoy social studies class always/most of the time	43%

The picture is different at grade 8. Sixty percent of eighth grade math teachers blame poor performance on indifference or lack of motivation. This is confirmed by student responses. Over 40 percent of both grade 8 and grade 12 students see their math and science courses as "mainly memorizing." Sixty percent believe this is true of social studies. Furthermore, as students progress, they see less utility in what they are studying.

How useful do you find social studies in . . .

	Not Very Useful	
Grade	8	12
understanding the world around you	11%	17%
getting along in everyday life	29%	45%

How useful do you find science in . . .

	Not Very Useful	
Grade	8	12
understanding the world around you	12%	21%
getting along in everyday life	27%	41%

How useful do you find mathematics in . . .

	Not Very Useful	
Grade	8	12
understanding the world around you	29%	45%
getting along in everyday life	16%	NA
doing practical jobs	NA	36%

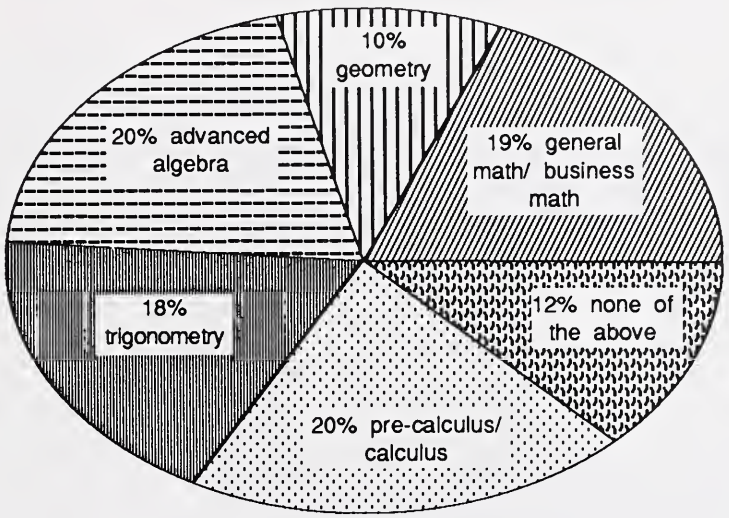
Although much has been made of the effects of home variables such as parental education, the greatest differential in achievement is between those students who enjoy a subject, work consistently at it and are engaged in learning that is stimulating and demanding and those students for whom school is little more than the memorization of facts and procedures.

Students: their course-taking.

In their high school years, Massachusetts students generally take more academic courses than is true nationally. When asked to describe their current school program, 58 percent of grade 12 students replied that they were in college preparatory; 27 percent were following a general course of study; and 14 percent were in a vocational or technical course of study. (This excludes students who were attending vocational schools.)

Math:

STUDENT COURSE ENROLLMENT AT GRADE 12



English:

What is your current English course?

		Percent response
A.	Advanced placement or honors	15%
B.	College preparatory	48%
C.	General	33%

Social Studies:

Percentage of Students Studying the Following Topics for Two or More Semesters:

	Percent
government/civics/political science	39%
American history	77%
world civilization/history	52%
geography	13%
psychology/sociology/anthropology	26%
economics	12%

The Relationship among Course-Taking, Attitudes and Performance.

- **As students progress through school the education that they receive begins to differ in fundamental ways.** Whereas most children are exposed to a similar curriculum in the elementary grades, by grade 8 many are grouped in terms of level of instruction and subject matter. This grouping affects both their academic performance and their attitude toward school.

  In grade 8 there is a 350-point difference in assessment scores between the 23 percent of students who are taking algebra and the 41 percent who are following a course in general math. By grade 12, the gap in performance between students who are following different mathematics courses has almost doubled to 600 points, representing the entire range of scores on the assessment test.

- **It is difficult to believe that curriculum and instruction do not contribute to that widening differential in achievement, particularly in mathematics.** Mathematical topics that go beyond computation are considered appropriate primarily for more advanced students. Students who do not perform well in mathematics spend most of their time on basic procedures with fractions, decimals and percentages. This emphasis may account for the relatively negative attitude toward mathematics among students in less demanding courses.

- **The differentiation among pupils that occurs most dramatically in mathematics is also apparent in the area of science.** By grade 12, there exists a relatively small group of students (approximately 10 percent) who are very interested in science, spend time working on it and are planning a career in science. These students performed extremely well in both the math and science portions of the assessment, and significantly better than they did in reading or social studies. Their scores sharply contrast with the scores of those 45 percent of students who believe that science involves mostly memorizing and those 32 percent of students who state that they are not at all interested in science.

PRACTICES ASSOCIATED WITH ACHIEVEMENT

SCHOOL CLIMATE: HIGH-PERFORMING SCHOOLS

Through the association of questionnaire results and achievement scores, we are able to identify some of the instructional practices of schools with high performance on the assessment.

[Associations such as these do not imply that these factors are responsible for high achievement.]

- High-performing schools include analysis and evaluation skills in their math, science, reading and social studies curriculum.

- High-performing schools have resources and use those resources. At grade 4, resources include classroom libraries, mathematical manipulatives and other "hands-on" learning materials. At grades 8 and 12, they include laboratories and scientific equipment and supplies.

- High-performing schools involve their students in active learning. At grade 4, their students collect data, make graphs, share papers. At grades 8 and 12, they engage in research projects, write papers, discuss and evaluate their reading material.

- High-performing schools rely on a variety of instructional methods and sources. They use more than one text as a resource; they ask students to engage in different types of instructional activities; they demand the application of skills and knowledge in different contexts.

- High-performing school demand more (and higher quality) homework and writing from their students. The emphasis is on "doing" rather than receiving information from the printed page.

FINAL WORDS

In each of the areas tested by the assessment, curriculum experts have been suggesting new ideas about learning. Prominent among these ideas are:

- **The effect of prior knowledge.** The metaphor of the child as an empty vessel to be filled with knowledge has been discredited. Instead, educators increasingly recognize that each child enters school with a unique history of ideas and rationale for making sense of the world. In those cases where school learning is congruent with these beliefs, prior knowledge is an advantage. In others, it serves to confuse. In all cases, for effective instruction, teachers should be aware of what their students know and how they think.

- **Intelligence as active involvement.** The concept of intelligence as a quantifiable and immutable characteristic of the individual has been displaced by the idea that intelligence is a characteristic of behavior, resulting from knowledge and experience. People show intelligence by engaging in intelligent behavior. In its turn, intelligent behavior results from active involvement. It is an ongoing process that is dependent upon new experiences and feedback.

- **Expert behavior as a criterion for performance.** There is a greater distinction between knowing what and knowing how, with the former suggesting passivity, the latter actvity. To be an expert, it is not sufficient to know one's subject area; one must be able to apply that knowledge to the solution of problems. The goal of education, then, is the ability to transfer the knowledge that is acquired in one highly structured situation (the classroom) to those unstructured situations that are more typical of everyday life.

These ideas have influenced how students are viewed, what students are taught, how they are taught, and how their learning is measured. Basically, it is a hopeful view, with the goal of creating engaged and interested learners. An important purpose of the assessment is to measure how well we have achieved this goal in Massachusetts.

OTHER PUBLICATIONS OF THE MASSACHUSETTS EDUCATIONAL ASSESSMENT PROGRAM:

Reading and Thinking
Moving Geometry from the Back of the Book
Social Studies Report
1988 Statewide Summary Report
Description of 1988 Test Content and Reporting Categories

Additional copies of this brochure and the publications listed above are available from any of the following regional centers.

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